THE NATIONAL GEOGRAPHIC MAGAZINE

Vol. XIV JULY, 1903 No. 7

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WASHINGTON, D. C.

VOL. XIV, No. 7 WASHINGTON JULY, 1903

THE NATIONAL GEOGRAPHIC MAGAZINE

THE UNITED STATES; ITS SOILS AND THEIR PRODUCTS*

BY H. W. WILEY, PH. D., LL. D.

CHIEF CHEMIST, U. S. DEPARTMENT OF AGRICULTURE

DR DAY, in saying that I had come to take the place of the Secretary of Agriculture, reminds me of the remark of Oliver Wendell Holmes, on an occasion when by reason of the illness of Emerson he was sent to one of the lyceums to fill Emerson's appointment. The president of the lyceum stated that they had expected to listen to Mr Emerson, but by reason of illness they would not have that pleasure. However, Mr Holmes had kindly consented to fill his place. Whereupon Mr Holmes on rising remarked that he hardly hoped to fill the place of Mr Emerson, but would attempt to rattle around in it a little; so to-day I cannot hope to fill the place of the Secretary of Agriculture, but will make as much noise in the large space unoccupied as possible.

ORIGIN OF THE SOIL

One of the oft-repeated theories concerning the origin of our earth is that at a remote period all the matter of which the earth consists at present was a part of the incandescent gas which filled the space now assigned to our solar system. As the cooling of this mass of gas progressed vortex rings were formed of gaseous matter. These on further cooling broke and rolled together, forming the sun, the planets, and the satellites of our present system. The next condition of the incandescent gas was incandescent liquid, which came in due season as the time rolled by. Finally, by the further process of cooling, a crust was formed upon the surface of these liquids which was the beginning of the solid surface of the earth. This crust would naturally be of the same composition as the liquid matter from which it was formed—practically homogeneous in character and consisting of the mineral matters which could only exist at that temperature.

In speaking of the soils of the United States, I would like to trace briefly their evolution from this primeval crust, which was the first ice formed on this

*Address before the National Geographic Society, February 18, 1903

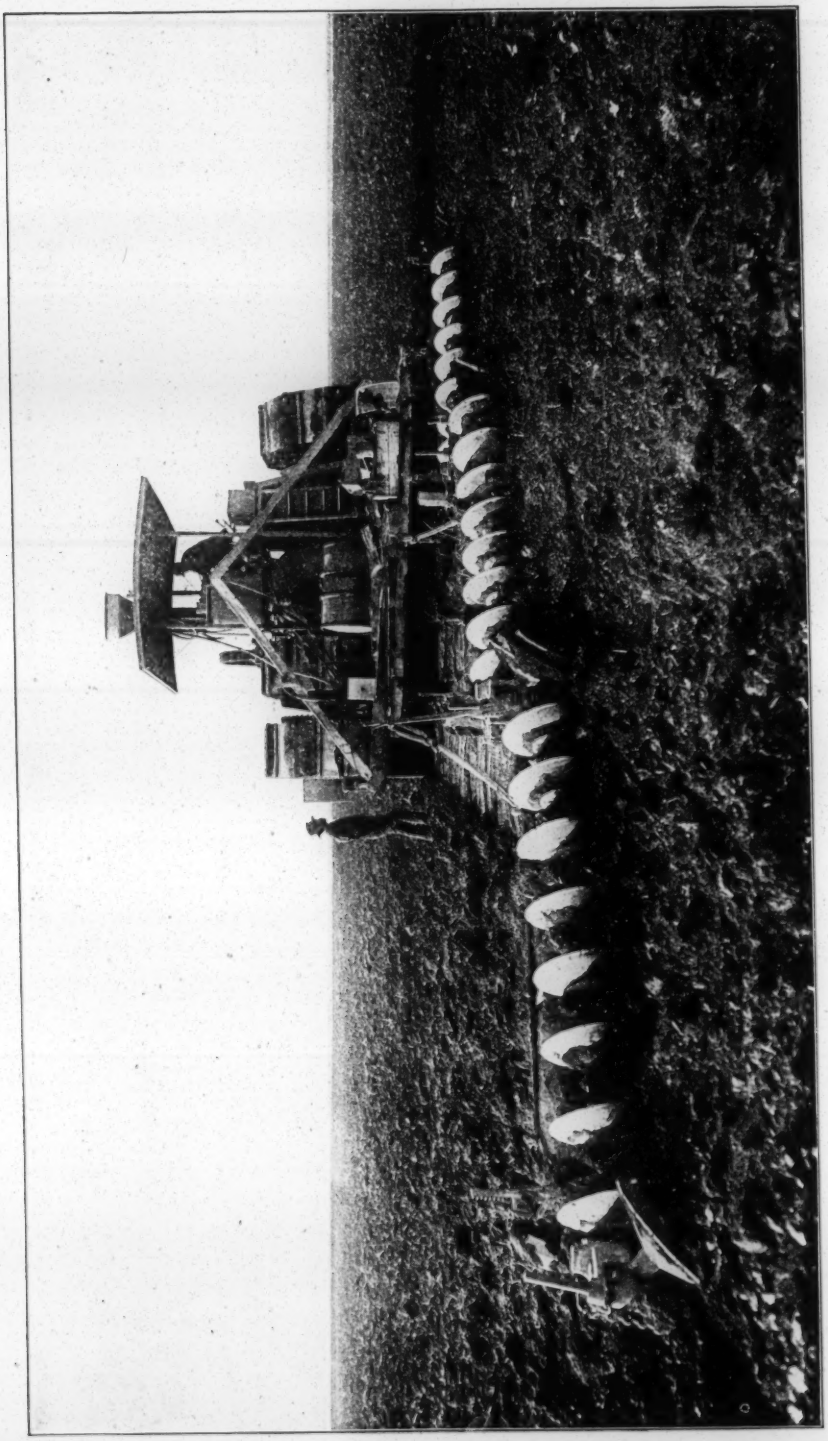
globe. What have been some of the more active forces which have broken up this congealed mineral matter and brought it into the present condition in which we see the surface of our globe? First of all I will speak of the action of water, which is and has been one of the chief disintegrating agents acting upon the earth's surface. At the time the first crust was formed over the surface of the earth all the water which now exists must evidently have been above the earth's surface in the form of steam. As the cooling progressed this steam tended to condense in the form of clouds and finally water. Thus the original rain falling upon the hot surface of the earth was at once converted again into steam, but not until it had started a certain solvent action. Water has been termed the universal solvent, and it is not difficult to see how active it must have been at the time of which I speak. The sudden cooling of the surface at the spot where a drop of water struck would tend to crack it, the hot water would dissolve quickly any of the substances soluble therein, and this continual bombardment of boiling water must have had a tremendous effect in disintegrating the original crust formed over the earth's surface. As the earth continued to cool and diminish in size, the original surface wrinkled and formed hills and valleys. The continual descent of water would finally permit some of it to remain in the liquid state upon the earth's surface, and this coursing down the valleys continued the disintegration, both by solution and attrition. The original mineral matters were thus brought into a form of solution or suspension, and, seeking their natural chemical affinities, began to form from the first igneous rocks the first sedimentary rocks. These are the rocks which we now see in strata, covering the greater part of the earth's surface. All these stratified rocks must have been laid down under the water, and thus we are convinced that the surface of the earth during the long period of the formation of the soil must have been alternately above and below the surface of the water collected upon the globe.

INFLUENCE OF ORGANIC LIFE

When organic life came upon the earth's surface a new disintegrating force was introduced. Organic life, even in its smallest forms, such as bacteria, acts with vigor in decomposing rocks. The larger forms, which produce rootlets, help this disintegrating process along. These roots find their way into crevices of the rocks, and tend to split them open and to admit water below their surface. Certain bacteria also tend to oxidize the nitrogen of the air and form nitric acid, known under the common name of *aqua fortis*, which has a vigorous solvent action on many kinds of rock.

DIFFERENT KINDS OF SOIL

In the process of further cooling, ice was formed, and this also tended to have a disintegrating influence. Water in passing into ice increases in volume, and this tends to break and disintegrate many bodies. Rock saturated with water thus tends to break up when the water becomes ice. During the period of the ice age when large glaciers moved over the earth's surface, the crushing and grinding effects of the ice had much to do with disintegrating the rock. The vast areas of glacial drift which form the soil of many of our Western States are evidences of the gigantic scale on which these ice mills of the gods slowly ground the stones of the earth into soil. When the soil is formed by the decay of rocks without the transporting action of water or ice being active, the soils are said to be formed *in situ*. When the products of soil disintegration are carried by water and deposited along the banks of the streams or at their mouths, the soil is called alluvial. When



From Edwin S. Holmes, U. S. Department of Agriculture

A Steam Plow in the Great Valley of California

From Edwin S. Holmes, U. S. Department of Agriculture

Front View of a Steam Harvester-Thrasher Used on the Pacific Coast

Ponderous machines like the one shown in this picture sweep through miles upon miles of ripened grain, cutting swaths from 16 to 42 feet in width, harvesting, cleaning, thrashing, and leaving behind a long trail of sacked grain, ready to be hauled to the warehouse, railroad, or mill. The machine can harvest from 60 to 125 acres a day, and requires only eight men to operate it. It can be used successfully only on a grain perfectly dry, as well as thoroughly ripe.

From Edwin S. Holmes, U. S. Department of Agriculture

Rear View of Steam Harvester-Thrasher

Showing the bags of harvested grain left behind as the machine advances

products of rock disintegration are carried by moving ice and deposited therefrom, they are called glacial drift. When they are carried by wind, as is often the case, they are called æolian soils. The above are some of the varieties of soils as determined by their method of formation. Soils are also classified in regard to their chemical characters; as, for instance, when formed from the decay of carbonate of lime, they are called limestone soils. When arising from the disintegration of granite, they are called granitic soils. When formed chiefly from particles of silex, they are called sandy soils. When consisting mostly of silicate of alumina, they are called clay soils, and so on.

But for agricultural purposes the soil consists of more than decayed mineral matter. By the decay of organic matter there is introduced into the soil the element, humus, which is one of its principal characteristics from an agricultural point of view. The soil is filled with millions of organisms of a lower form, without whose activity the growing of crops would be impossible. The soil, therefore, not only contains the mineral matters which are necessary to sustain the life of plants, but also those organic elements without which these mineral matters would not be available for plant growth. The three principal mineral foods of plants are potash, phosphoric acid, and nitrogen. Lime, magnesia, iron, and many other mineral substances are also found in plants, but these are not absolutely essential to plant growth. If, however, either nitrogen, potash, or phosphoric acid be entirely removed from the environment, it is impossible to produce a matured plant. The great bulk of the material of which plants are composed is not drawn, however, from the soil, but is taken from the air and water. Great as have been the chemical achievements of man, no chemist has yet arisen whose skill can be compared to that of the plant itself. Any chemist who to-day, with all the appliances which science has placed at his disposal, could make by synthesis the various organic compounds of which plants are principally composed would rival the fame of Berzelius, Liebig, Hoffman, Berthelot, Gibbs, or Remsen. Thus the soil must be regarded as that part of plant life which furnishes the chemical support for the growing plant, supplies it with the mineral foods essential to its growth and maturity, and favors best those conditions which enable the plant cell to elaborate the organic matters of which the matured plant is chiefly composed.

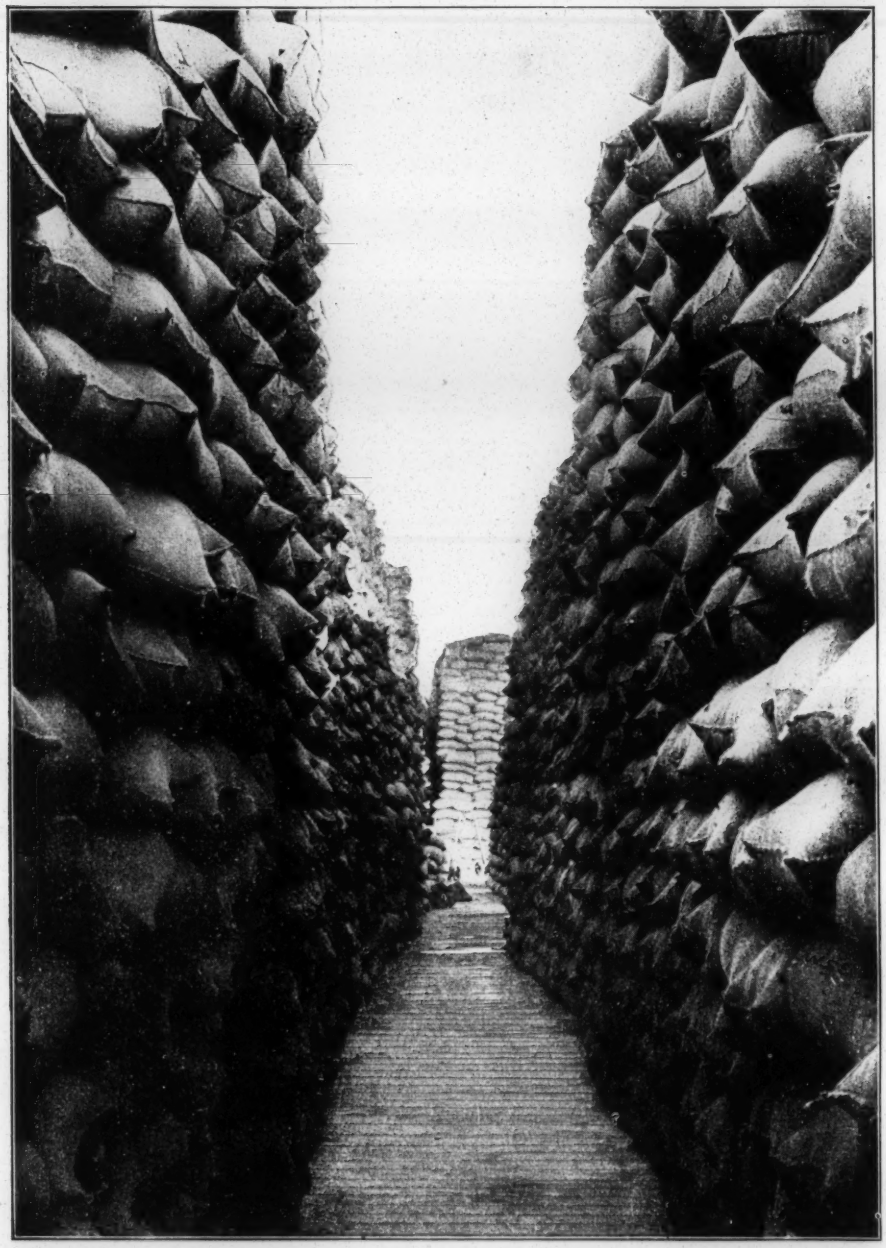
THE UNITED STATES AN AGRICULTURAL COMMUNITY

Having thus briefly described how the soil originated, we pass to the consideration of the second part of the subject, namely, the crops which grow therein.

The United States is essentially an agricultural community. The basis of its wealth lies not so much in the products of its mines and manufactures as it does in those of its fields, gardens, orchards, and forests. The territory of the United States, including its new possessions, represents every variety of soil and every character of climate. It has agricultural lands in the tropics, in the subtropics, in the temperate zone, and in the sub-boreal regions of Alaska. In latitude its agricultural lands extend half way around the world. Agricultural crops are grown in the United States subject to all the vicissitudes of climate, to excessive rainfalls, to prolonged drouth, to intense heat, and to alternating frosts and sunshine.

Within the borders of the United States are grown every agricultural crop known to the world. It produces immense quantities of the cereals; of fiber plants, including especially cotton and flax; of sugar-producing plants, including sugar cane, sugar beets, sorghum,

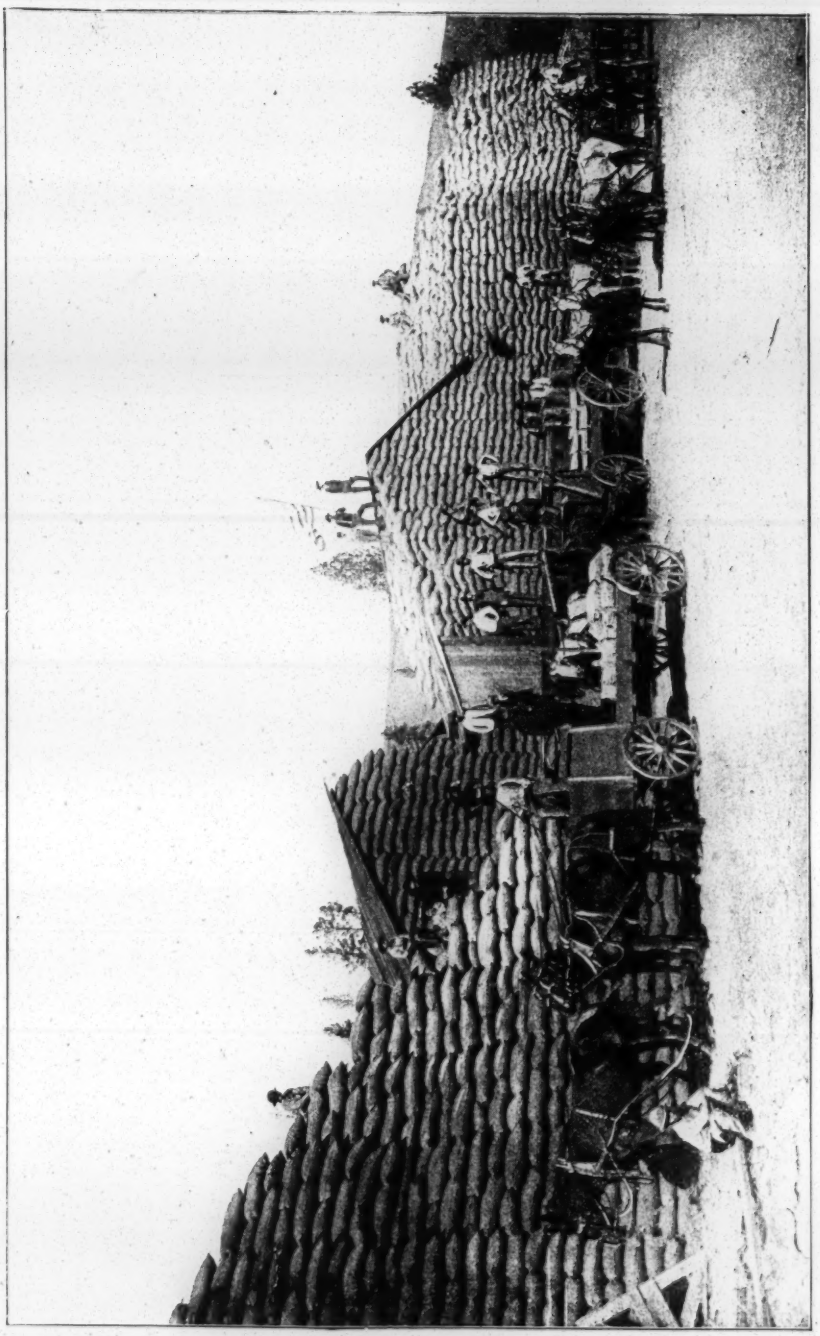
XUM



From Edwin S. Holmes, U. S. Department of Agriculture

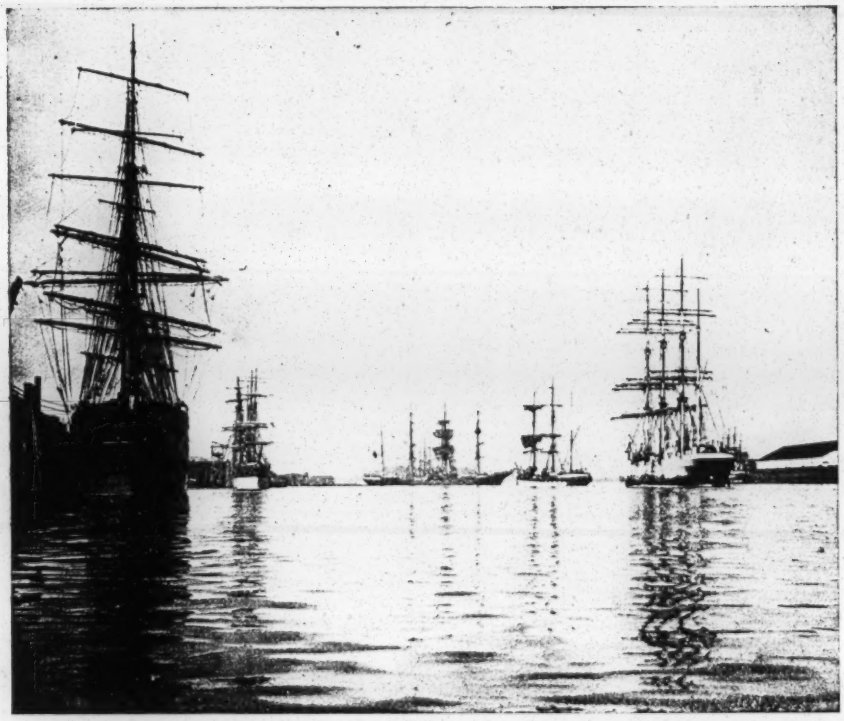
Between the Walls of 100,000 Sacks of Wheat at Mission, Oregon

The warehouse is 56 feet wide and 310 feet long. There are 250,000 bushels of wheat in the sacks



From Edwin S. Holmes, U. S. Department of Agriculture

Sacked Wheat Awaiting Shipment



A Portion of the Grain Fleet in Portland Harbor, Oregon

and maple trees; all kinds of vegetables and fruits; medicinal plants of every variety; forest products of all kinds; spices and condiments of every description.

MAGNITUDE OF THE CEREAL CROPS OF THE UNITED STATES

As an introduction to the discussion of the subject embraced in this paper, a brief statement of the magnitude of some of the agricultural crops of the United States and the area under cultivation will be useful. In the year 1902 the following statistics show the area under cultivation, the yield per acre, the total production and the price per unit, and *in toto* the magnitude of our standard agricultural crops: The crop which is universal in the United States is maize or Indian corn. There is only one state in the Union in which a considerable area of Indian corn is not grown, viz., the State of Nevada, and it, as is well known, is a barren desert, except where irrigation can be practiced. The total area under cultivation in the United States in maize in 1902 was 94,043,613 acres. The total production was 2,523,648,312 bushels. The price per bushel was 40.3 cents. The total value of the crop was $1,017,017,349. The largest acreage devoted to maize in any one state was in Illinois, viz., 9,623,680 acres, yielding 372,436,416 bushels. The smallest reported area in any one state, with the exception of Nevada, as above mentioned, was 2,384 acres in Wyoming.

After maize the most important cereal

crop in the United States is wheat. The area in 1902 was 28,581,426 acres in winter wheat, and 17,620,998 acres in spring wheat, a total of 46,202,424 acres. The average yield per acre of winter wheat was 14.4 bushels. The total quantity of winter wheat produced was 411,788,666 bushels, and the average price was 64.8 cents per bushel. The total value of the winter wheat was $266,727,475. The average yield of spring wheat per acre was 14.7 bushels. The total production was 258,274,342 bushels. The average price per bushel was 60.2 cents. The total value of the spring wheat was $155,496,642. Placing the two sets of data together, we find the total yield was 670,063,008 bushels and the total value was $422,224,117.

The area sown to oats in the United States in 1902 was 28,653,144 acres. The average yield per acre was 34.5 bushels. The total yield was 987,842,712 bushels. The average price per bushel was 30.7 cents. The total value of the crop was $303,584,852.

The area sown to barley in the United States in 1902 was 4,661,063 acres. The total yield was 134,954,023 bushels and the total value was $61,898,634.

The total area sown to rye in the United States in 1902 was 1,978,548 acres. The yield was 33,630,592 bushels and the total value of the crop was $17,080,793.

The total area sown to buckwheat in the United States in 1902 was 804,889 acres. The total production was 14,529,770 bushels and the total value of the crop was $8,654,704.

The above comprise the principal cereal crops of the United States. They do not include, however, considerable areas sown to millet, sorghum, Egyptian corn, rice, and other cereals. Summarizing the above principal crops, we find the total area under cultivation was 176,343,681 acres; total production, 4,364,668,417 bushels; total value, $1,830,460,449.

COTTON CROP VALUED AT NEARLY FIVE HUNDRED MILLION DOLLARS

The area of cotton harvested in the United States in 1902 was 27,114,103 acres. In addition to this, 764,227 acres were planted to cotton, which were not harvested. The total production of cotton lint was 5,111,870,028 pounds.

The price per pound for cotton at Galveston February 6, 1903, was 9 cents, making the total value of the crop $460,068,303.

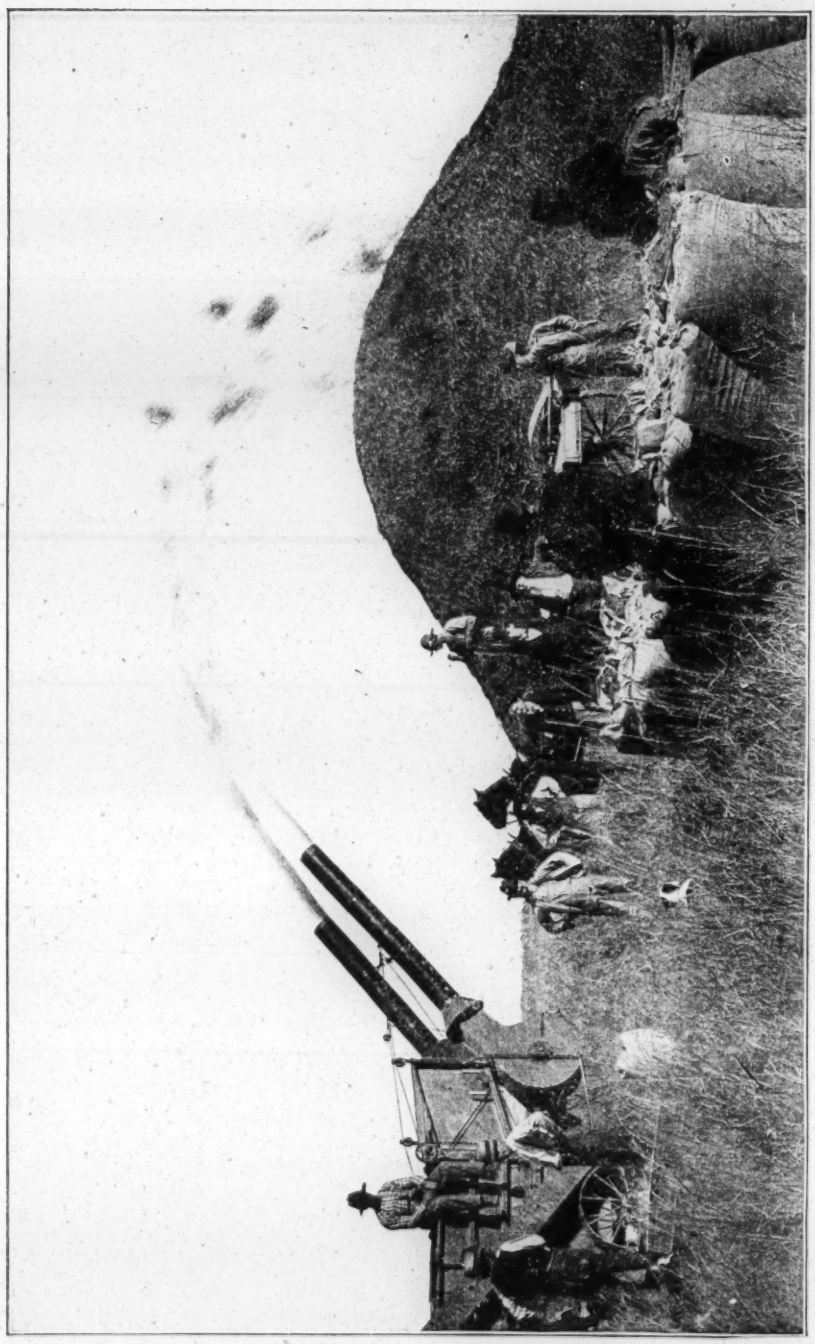
The area devoted to hay-making in the United States in 1902 was 39,825,227 acres and the yield 59,857,576 tons of 2,000 pounds each. The price per ton was $9.06. The total value of the crop was $542,360,364.

The total area planted to potatoes in the United States in 1902 was 2,965,587 acres. The yield was 284,632,687 bushels. The average price per bushel was 47.1 cents. The total value of the crop was $134,111,436.

The total area planted to tobacco in the United States in 1902, excluding Porto Rico and the Hawaiian Islands, was 1,300,734 acres. The total yield was 821,823,963 pounds. The total value was $80,472,506.

The total number of tons of sugar beets harvested in the United States in 1902 was 1,777,639 tons of 2,240 pounds. The total number of tons of sugar produced was 195,800 of 2,240 pounds. The acreage in beets is difficult to determine, but it may be assumed that the average crop was about eight tons per acre, which would make the total acreage 24,475 acres. The average price of the sugar was about four cents per pound, making the total value of the crop $17,543,680.

The total quantity of cane sugar made in the United States in 1902 was 767,000 tons of 2,240 pounds each. Of this amount Louisiana furnished 250,000 tons, Porto Rico 100,000 tons, the Hawaiian Islands 315,000 tons, and the



From S. A. Knapp, U. S. Department of Agriculture

Thrashing Rice With a Steam Thrasher in Southwestern Louisiana

From S. A. Knapp, U. S. Department of Agriculture

Harvesting Rice in Southwestern Louisiana

Rice is the only cereal crop of which the United States does not produce enough for its own consumption. Recent improvements in the cultivation and harvesting of rice are, however, increasing the annual crop, which now amounts to one-half of what we consume

Philippine Islands (exports) 102,000 tons.

Most of the cane sugar was raw, and did not bring so high a price as beet sugar, which was mostly refined. The average price of the cane sugar may be taken at three cents per pound. The total value of the crop was therefore $51,542,400.

The area planted to flax for the production of flaxseed in 1902 in the United States was 3,739,700 acres. The quantity of seed produced was 29,284,880 bushels, and the value of the crop was $30,814,661. In this valuation no account is made of the value of the flax fibers.

The area in hemp in the census year was reported as 16,042 acres, yielding 11,750,630 pounds of fiber valued at $546,338.

The area in vegetables, excluding potatoes, in the census year was 2,814,139 acres, producing a crop valued at $143,782,534.

The total area devoted to the production of peas in the census year was 968,371 acres, yielding 9,440,269 bushels valued at $7,909,074.

The total area devoted to the cultivation of peanuts was 516,658 acres, producing 11,964,959 bushels valued at $7,271,230.

The area devoted to the cultivation of castor beans was 25,738 acres, producing 143,388 bushels valued at $134,084.

The total area planted to hops in the census year was 55,613 acres, producing 49,209,704 pounds valued at $[illegible],084,929.

The area devoted to the cultivation of broom corn in the census year was 178,584 acres, producing 90,947,370 pounds and valued at $3,588,414.

THE FRUIT CROPS

The total value of the fruit crops of all kinds in the United States in the census year was $131,423,517. Of this amount $83,751,840 was the value of the orchard fruit; $25,030,877 the value of the small fruits; $14,090,937 the value of the grapes, and $8,549,863 the value of the citrus and subtropical fruits.

The number of orchard trees of the different kinds in the United States in the census year was as follows:

Apple trees	201,794,764
Peach and nectarine trees	99,919,428
Pear trees	17,716,184
Plum and prune trees	30,780,892
Cherry trees	11,943,287
Apricot trees	5,010,139

The total area in fruit trees in the United States is 6,230,745 acres. The total area in small fruits is 304,029 acres, and the total value of the small fruits produced $25,030,877.

The number of olive trees in the United States in the census year was 1,540,155, and the number of pounds produced was 5,053,637.

The number of nut trees in the United States in the census year cultivated on farms was 1,649,072.

THE NUMBER OF FARMS

The total area under irrigation in the census year in the United States was 7,263,273 acres, and the value of the irrigated crops was $84,433,438.

The total area of the United States, including Alaska, Porto Rico, and the Hawaiian Islands, is 3,613,217 square miles, equivalent to 19,768,604,880 acres.

The number of farms in the United States in the census year was 5,739,657. The average number of acres in each farm was 146.6. The total acreage of the farms in the United States was 841,201,546. The value of the farm property in the United States in the census year was $20,514,001,838. The value of the farming implements and machinery was $761,261,550. The value of the live stock on the farms was $3,078,050,041.

The total value of the farms of the United States in the census year was

A Field of Pumpkins Grown for Seed

$16,674,690,247, of which the land, with improvements except buildings, was $13,114,492,056 and the farm buildings $3,560,198,191.

Of the 5,739,657 farms in the United States 2,024,964 were operated by renters, and 3,714,693 were operated by their owners.

NUMBER AND VALUE OF FARM ANIMALS

The number and value of farm animals in the United States on January 1, 1903, as estimated by the Statistician of the Department of Agriculture, were as follows:

Animals.	Number.	Valued at—
Horses	16,557,373	$1,080,705,959
Mules	2,728,088	197,753,327
Milch cows	17,105,227	516,711,914
Other cattle	44,659,206	824,054,902
Sheep	63,964,876	168,315,750
Swine	46,922,624	364,973,688

The total number of farm animals was 191,937,394, and the total value of the farm animals was $3,102,515,540.

The total value of the agricultural and horticultural crops of the United States for 1902, as estimated by the Statistician of the Department of Agriculture, is $3,500,000,000, not including live stock, the annual value of which is estimated at $1,000,000,000, making the total value of the agricultural products of the United States for 1902 $4,500,000,000.

The total value of the agricultural exports of the United States for the year ending June 30, 1901, was $943,811,020, amounting to 64.62 per cent of the total exports of all kinds from this country. Some of the principal items included in the above are as follows:

Value of cattle exported	$37,566,980
" " sheep exported	1,933,000
" " hogs exported	238,465
" " bacon and hams exported	60,341,804

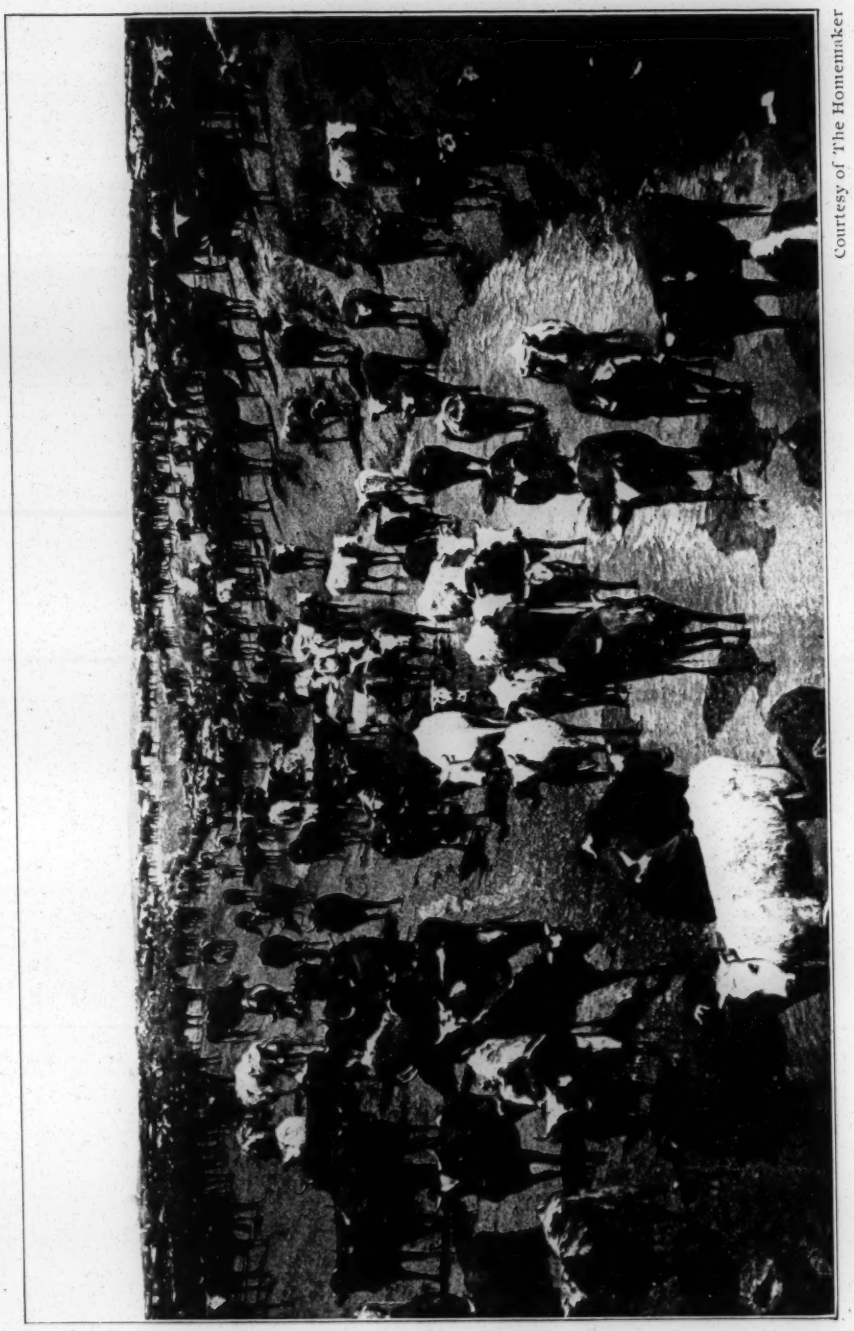
Value of pork exported	$13,059,551
" " lard exported	46,560,148
" " beef products exported	44,225,319
" " all other meat products exported	23,369,0 3
" " dairy products exported	9,403,722
" " cotton, raw	313,673,443
" " breadstuffs	275,594,618
" " tobacco, unmanufactured, exported	27,656,475

WILL OUR FOOD SUPPLY KEEP PACE WITH OUR ENORMOUSLY INCREASING POPULATION?

The foregoing data will show, in a general way, the vast agricultural resources of the United States. It is seen that we are not only able to feed our own people, but millions of people in other countries.

There is one question which constantly presents itself to the mind of the political economist, namely, Is the rate of increase in population to be diminished, or, if continued, will the food supply be exhausted in the near or remote future? In looking for answers to these questions, political economists must consult scientific agriculture. In the application of the principles of agriculture to science is found the only safe response. It is certain that under the fostering care of this country and with wise and well-directed engineering, many millions of acres of rich land can be procured for agricultural purposes through irrigation. Science teaches us in many other ways the methods of making the farm, to a certain extent, independent of the variations in rainfall. The true principles of conserving moisture for the purpose of crop production, and of utilizing to the best advantage the excess of precipitation, are now well known and are daily taught to our people. Scientific forestry is increasing the number of trees and bringing large areas into tree culture which before were only featureless plains. What the effect of tree planting will be upon the climate is not known with certainty, but the general impression is that

A Field of Silverskin Onions on Bloomsdale Farm, Philadelphia



Courtesy of The Homemaker

Cattle being Fattened for Export

the more abundant the growth of trees, the more readily is moisture preserved for agricultural purposes while the intensity and extent of floods is diminished.

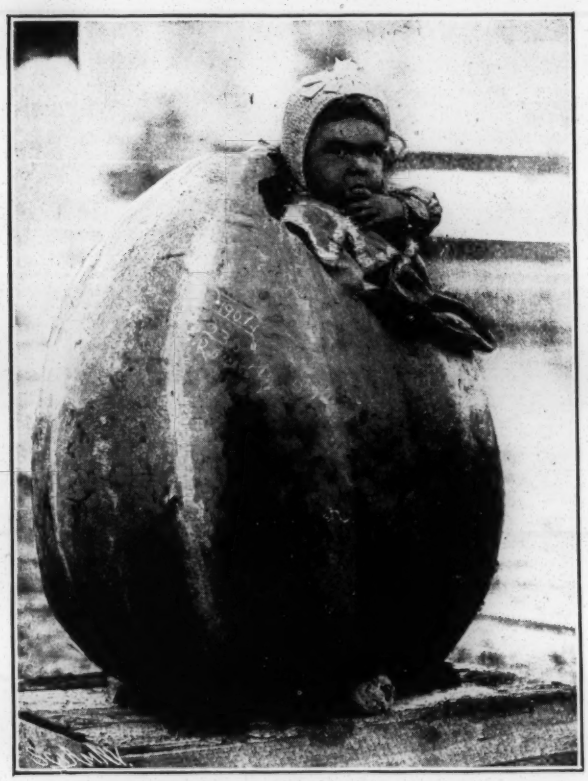
The true principles of fertilization are annually increasing the average product of the older farm lands of the community. The principles of cattle feeding are introducing important economies into the utilization of farm products. We have no reason to think that the average wheat crop, for instance, in the United States would not increase in the amount grown per acre An increase of a single bushel per acre will give, in round numbers, an increase of sixty million bushels to the crop. The scientific farmer can readily double and treble his crop, and so, without increasing the acreage, supply double or treble the amount of wheat. The same principle is true of other crops. The future soil fertility will increase, not diminish. The average output of each acre will grow. While the capacity of the mouth to consume remains constant through all centuries, the capacity of the hands to furnish food is constantly increasing. We need not fear, therefore, a period of world starvation due to the exhaustion of the food-producing capacity of the soil. If universal hunger does come, it will not be from this cause. It may be—I would not deny it—that the final fate of man on earth is starvation or freezing, but the remote future at which such calamities can occur makes their event for practical purposes infinitely removed. We are now feeding, within the boundaries of the United States, eighty million people. When in a hundred years from now we are feeding two hundred million people, the quantity of food per head will be no less abundant than at present. In those days now so near at hand agriculture will be more a science and more an art. The fields will all be gardens, and the forests sources of income without destruction. The life of man will be full of amenities which are now denied the tiller of the soil, and the true aristocracy of the earth will be composed of those in direct touch with earth herself.

BIG THINGS OF THE WEST*

By Charles F. Holder

WHETHER rightly or not, the West has earned a reputation for big things—big fishes, big fruit, big trees; and so many really big things come from this section of the country that possibly some of the inhabitants fall naturally into the habit of telling big stories and painting as they rise. There are, however, certain peculiar conditions that hold on the Pacific slope that justify the story-teller. The West has the largest trees in the great Sequoias which rear their lofty heads two or three hundred feet in air. It possesses the giant redwoods, which possibly rank next in size and usefulness, great forests extending all along the fog-laden country of northern California. In Alaska we find the highest mountains in America, and the largest and most numerous glaciers, beginning with Muir and Malaspina, the latter the most remarkable glacier in the world. The stroller through the markets of San Francisco will find the western representative of the New York weak-fish—a huge creature ranging from eighty to one hundred pounds—and will be told

*Reprinted from the Scientific American Supplement by courtesy of Munn & Co.

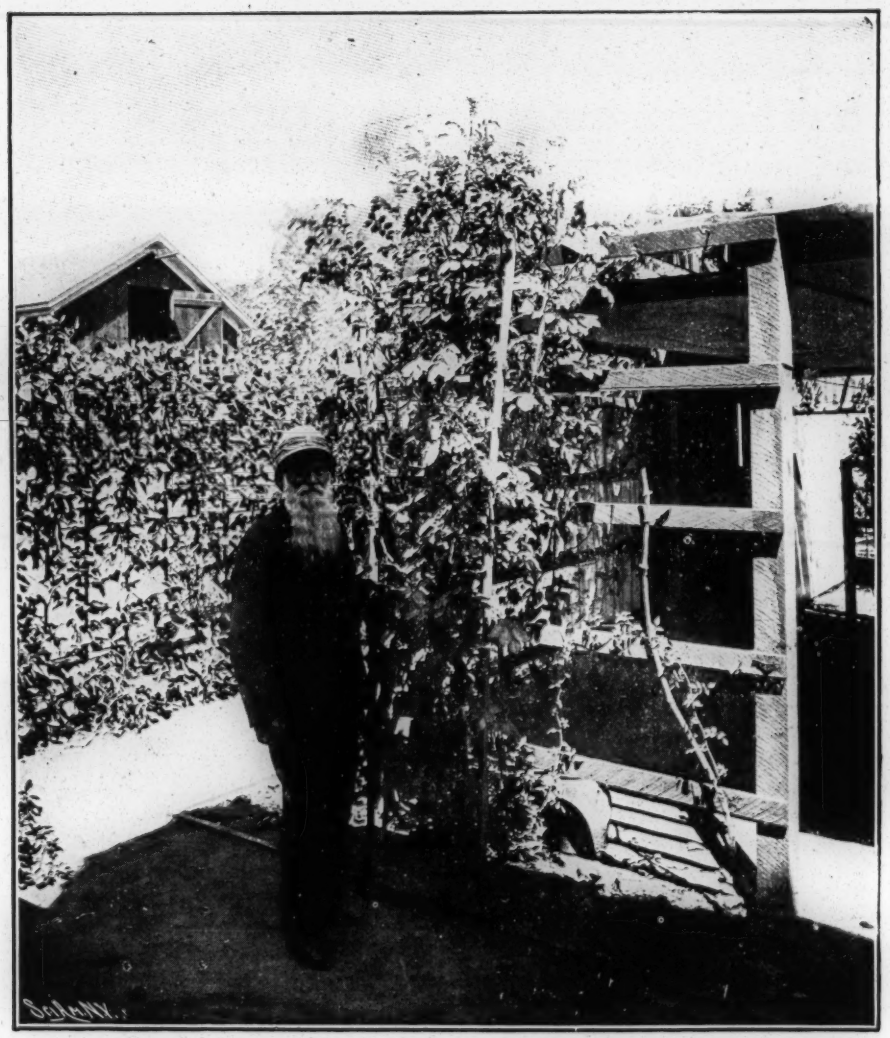


Courtesy of the Scientific American Supplement

A Colossal Californian Pumpkin

that a similar fish is caught in the Gulf of California weighing two hundred pounds. In the Italian quarter of this city will be seen the octopus, or devilfish, hung up for sale, a terrible array of arms or tentacles; not the little creature a foot or two across common in the East, but a veritable monster with a radial spread of perhaps twelve or fourteen feet. Along the upper coast these animals have been found with a radial spread of twenty-five feet—well named the spider of the sea. Along the coast will be seen a bass which often tips the scales at five hundred pounds; and at Monterey has been taken a mackerel weighing nine hundred pounds—suggestive that even fishes grow large in western waters. In Alaskan waters is found a monster clam, the "geoduck," one of which would afford a meal for several persons; not so large however as the great tridacna and its species, which weighs, with its two valves, five hundred pounds, the animal alone weighing thirty. This shell, though common in California, is from the equatorial regions of the Pacific, where, buried in the soft rock, its viselike jaws partly open, it is a menace to the natives who wade along the reefs searching for shells.

In southern California the vegetation is often remarkable for its size. At Santa Barbara is a grapevine which covers several hundred square feet, the vine itself resembling a tree, said to be the largest vine in the world, though this is open to doubt, for some of the old vines of Spain are of enormous size. Whether it is due to the newness of the soil and the fact that it is not yet exhausted by successive farming is not known, but nearly everything here grows very large and rapidly. The tree known as the Australian black wattle will attain a height of fifty or more feet in five years, palms the same height in less than twenty years, and eucalyptus one hundred feet in less time; so that it is a common saying in southern California that barren ground can be taken and made to look like a place fifty years old in five years. The extraordinary growth of flowering plants and shrubs in southern California is noticed. The eastern heliotrope grows in the form of a vine reaching twenty feet upward, covering the fronts of houses, in some way resisting the frost if at all protected by overhanging roof. In the city of



Courtesy of the Scientific American Supplement

A Giant Californian Potato Vine

Pasadena many remarkable examples of large growth are seen, one being a potato, which was trained to grow upon a trellis and assumed the form of a lusty vine over twelve feet high, producing an extraordinary number of potatoes.

Some of the photographs of fields of pumpkins taken in the fall in Southern California might well be considered open to suspicion, so enormous are the productions. One pumpkin exhibited by James F. Stewart & Co. in Los Angeles was so huge that a calf was held in the interior while a photog-

rapher took its picture. Doubtless the California rancher who raised this giant would tell the Eastern farmer that it was "not a good year for pumpkins, either." Another colossal pumpkin raised by J. J. Teague in 1901 weighed 230 pounds, and when dug out after the jack o' lantern fashion afforded a playhouse for the rancher's little daughter, if we may judge by the picture. In the old days California pears were famous all over the civilized world for their size, but today this reputation applies to all fruits. Strawberries grown here are sometimes so large that three or four would fill a plate. Sweet potatoes are often mammoth—four feet in length—while the oranges, the immense navels which sometimes hang upon the trees for a year, probably excel in size any similar fruit anywhere. In a Pasadena garden in the summer of 1902 could be seen string beans with pods three feet in length, presenting an extraordinary spectacle, and as though the vine was hung with green snakes. But this extraordinary growth cannot be attributed to the soil of Southern California, as the seeds are said by Mr Charles Richardson to have come originally from China, the growth not being abnormal, though doubtless when the wonderful plants are distributed over the state some patriotic Californian will claim that the bean is due to the remarkable soil and climate of California.

PAUL DU CHAILLU

PAUL BELLONI DU CHAILLU, who died at St Petersburg April 30, was born in New Orleans July 31, 1835. His birthplace was thus the same city to which Stanley nearly twenty years later drifted as a cabinboy, to be befriended and adopted by the merchant Stanley. Little is known of Du Chaillu's ancestors, except that they were of one of the old French Huguenot families that had settled in Louisiana. His father, a man of considerable means, was engaged in the West African trade and owned a "factory" or trading depot on the Gaboon coast, a few miles north of the Equator. Paul as a boy accompanied his father to Africa and lived for three or four years on the coast. He was a bright, enterprising youngster, who spent most of his time talking with the natives, hearing their stories and learning their dialects and ways of thinking and living. He liked better to listen to the stories of the native traders than to learn the business of his father. It was this personal knowledge of the native which enabled him afterward to travel for thousands of miles in the interior without being obliged to kill a single native.

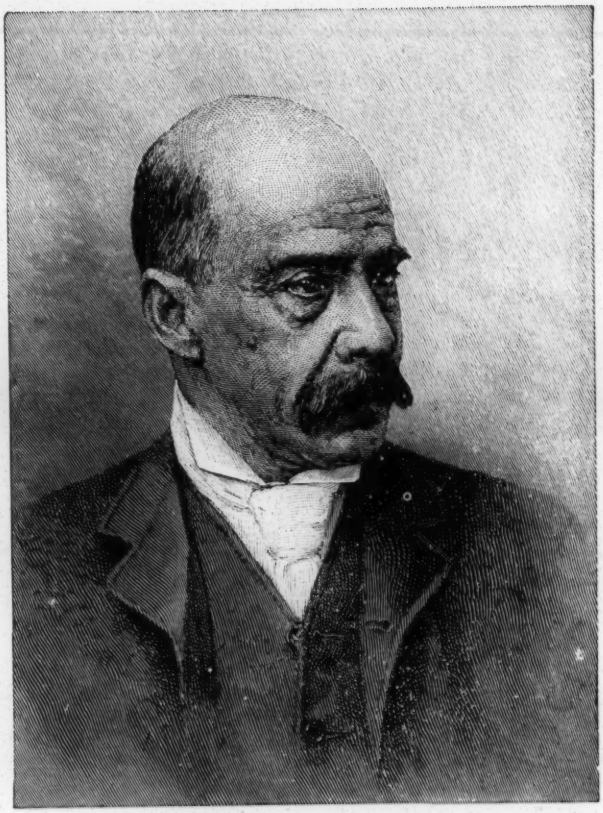
About 1853 his father took him back to the United States, but the wild tales the boy had heard had fascinated him and excited him to find out how much was true of what the seacoast natives said of the cannibals, pygmies, wildmen or gorillas, and other marvels of the Great Forest. No white man had previously penetrated more than a few miles into the interior along this part of the coast.

In the fall of 1856 he sailed from New York in a three-masted schooner and was landed at Gaboon in December. The following three and one-half years he passed exploring a section of Africa stretching from Gaboon 320 miles inland and 250 miles north and south. On his return to New York in 1859 he wrote the story of his discoveries, which was published by Harper & Brothers in 1861 under the title of "Explorations and Adventures in Equatorial Africa; with Accounts of the Manners and Cus-

toms of the People, and of the Chase of the Gorilla, Crocodile, Leopard, Elephant, Hippopotamus, and other Animals. By Paul B. Du Chaillu, with Map and Illustrations. Harper & Bros., 1861." In his preface he states:

"I traveled—always on foot, and unaccompanied by other white men—about 8,000 miles. I shot, stuffed, and brought home over 2,000 birds, of which more than 60 are new species, and I killed upwards of 1,000 quadrupeds, of which 200 were stuffed and brought home, with more than 80 hitherto unknown to science. I suffered fifty attacks of the African fever, taking, to cure myself, more than fourteen ounces of quinine. Of famine, long-continued exposures to the heavy tropical rains, and attacks of ferocious ants and venomous flies, it is not worth while to speak.

"My two most severe and trying tasks were the transportation of my numerous specimens to the seashore and the keeping of a daily journal, both of which involved more painful care than I like even to think of."



Courtesy of Charles Scribner's Sons

Paul Du Chaillu

Born July 31, 1835; Died April 30, 1903

In the book he told of gorilla, of which he had brought back the first specimens and which he had been the first white man to see and hunt; of the fierce cannibal tribes, the Fans, who filed their teeth to keep them sharp; of the ravages of the Baskouay ants, which marched in dense columns miles in length, and who were marshalled by officers and generals; of hunting elephants with pitfalls; of a new variety of snake, less than four feet long and six and eight inches thick, which lies in the open places in the woods and whose bite is instantaneous death, and of many other equally wonderful sights.

The book was greeted with shouts of laughter and derision from one end of the American continent to the other. Mr and Mrs and Miss Gorilla was the common jest, and the name Du Chaillu became a byword for a fanciful story-teller. Du Chaillu was only 26 when his first book was published. He was unable to answer satisfactorily the storm

of questions hurled at him; consequently nobody believed him, except Harper and Brothers in the United States and the Royal Geographical Society in England, both of whom valiantly and vigorously defended his truthfulness.

In 1863–'65 Du Chaillu made a second journey of exploration to Africa, the narrative of which appeared in 1867 as "A Journey through Ashango Land." This time he discovered the pygmies of the Dark Forest, but his descriptions of the little people were likewise received with incredulity. With this journey his explorations in Africa ended.

Gradually each of Du Chaillu's discoveries was confirmed by later explorers—by Schweinfürth, Stanley, Sir Harry Johnston, and others. Many years ago they were all verified; but the name Du Chaillu none the less still remains to most Americans that of a romance. In a certain sense Du Chaillu is himself responsible for this feeling, for all his descriptions are so vivid and are so thrillingly told that the reader feels he is reading a work of pure invention, rather than a narrative of actual experience.

His famous description of the first gorilla shot by a white man is worth quoting:

"Suddenly, as we were yet creeping along, in a silence which made a heavy breath seem loud and distinct, the woods were at once filled with the tremendous barking roar of the gorilla.

"Then the underbrush swayed rapidly just ahead, and presently before us stood an immense male gorilla. He had gone through the jungle on his all-fours; but when he saw our party he erected himself and looked us boldly in the face. He stood about a dozen yards from us, and was a sight I think I shall never forget. Nearly six feet high (he proved four inches shorter), with immense body, huge chest, and great muscular arms, with fiercely glaring, large, deep gray eyes, and a hellish expression of face, which seemed to me like some nightmare vision: thus stood before us this king of the African forest.

"He was not afraid of us. He stood there, and beat his breast with his huge fists till it resounded like an immense bass-drum, which is their mode of offering defiance; meantime giving vent to roar after roar.

"The roar of the gorilla is the most singular and awful noise heard in these African woods. It begins with a sharp bark, like an angry dog; then glides into a deep bass roll, which literally and closely resembles the roll of distant thunder along the sky, for which I have sometimes been tempted to take it where I did not see the animal. So deep is it that it seems to proceed less from the mouth and throat than from the deep chest and vast paunch.

"His eyes began to flash fiercer fire as we stood motionless on the defensive, and the crest of short hair which stands on his forehead began to twitch rapidly up and down, while his powerful fangs were shown as he again sent forth a thunderous roar. And now truly he reminded me of nothing but some hellish dream creature—a being of that hideous order, half-man, half beast—which we find pictured by old artists in some representations of the infernal regions. He advanced a few steps, then stopped to utter that hideous roar again; advanced again, and finally stopped when at a distance of about six yards from us. And here, just as he began another of his roars, beating his breast in rage, we fired and killed him."

In later years Du Chaillu traveled extensively in Sweden, Norway, Lapland, Finland, and other countries. He was the originator of the phrases "Land of the Midnight Sun" and "Land of the Long Night." In 1889 he published "The Viking Age," his most ambitious work, the result of many years of special research. He published his first book for young people in 1868, called

"Stories of the Gorilla Country." This was followed by many other similar books.

Mr Du Chaillu had many friends among the members of the National Geographic Society. His last public address in the United States was before the National Geographic Society, April 12, 1901, on the occasion of a farewell reception tendered him by the Society on the eve of his departure for Russia. His first lecture on his return was to have been before the National Geographic Society.

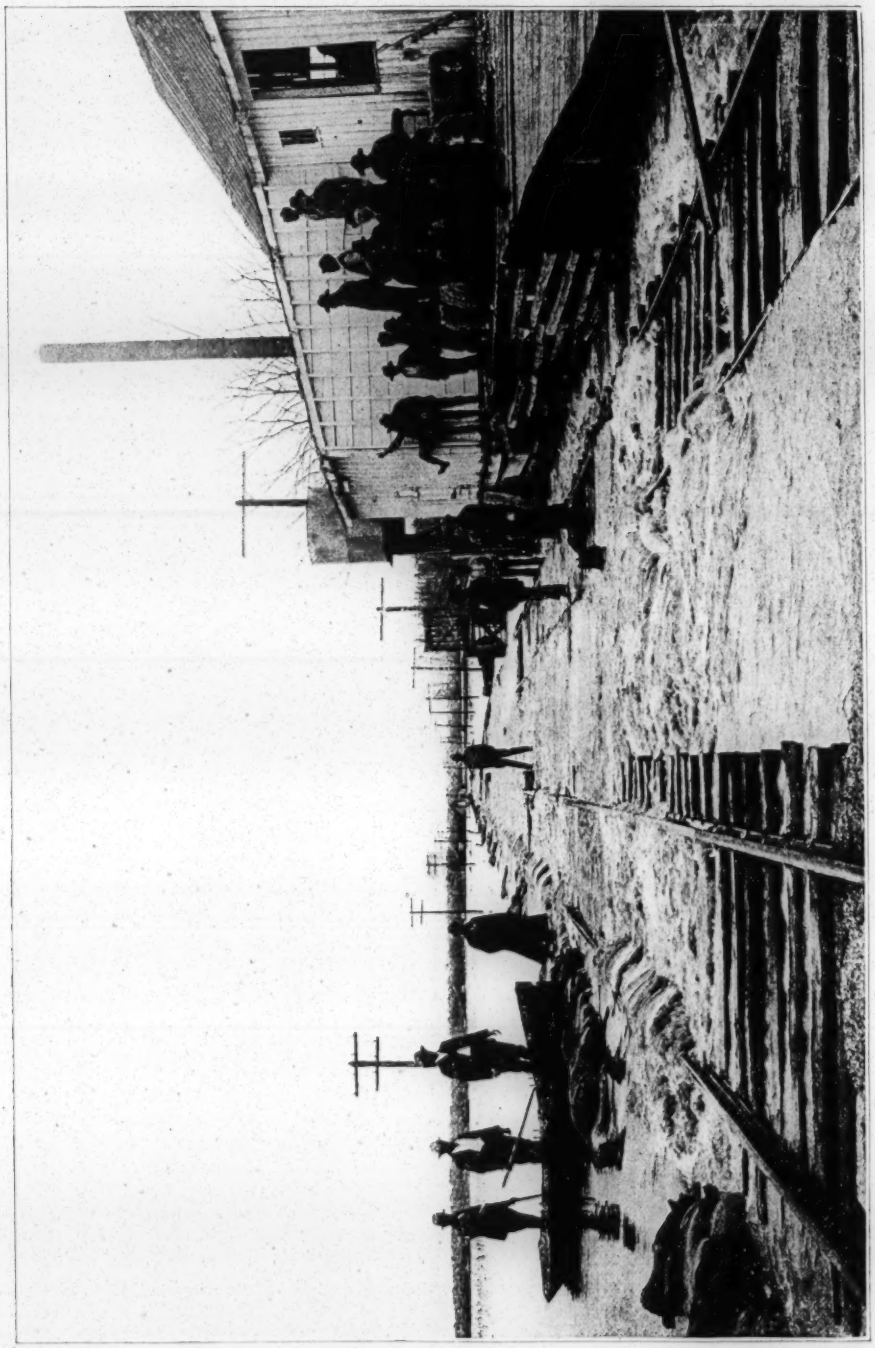
THE WEATHER BUREAU AND THE RECENT FLOODS

By H. C. Frankenfield,

Forecast Official, Weather Bureau

THE unprecedented floods that have occurred in the Mississippi and lower Missouri Rivers during March, April, and June of the current year have served to bring into considerable prominence a feature of the Weather Bureau work not at all familiar to the general public, with the exception of those who dwell within the districts directly affected. Reference is had to the River and Flood Service which, by the uniform accuracy and general high character of its work during the recent floods, has afforded a striking realization of the true function of the Weather Bureau, namely, that of providing as effectively as possible by means of its warnings for the personal safety as well as the material comfort and welfare of the people in times of impending disaster by wind and water. Ordinarily the work of the River and Flood Service is limited to the forecasting day by day of the coming stages of water in the navigable rivers of the country for the benefit of the commerce thereon, with an occasional local warning of an approaching flood due to excessive precipitation over a more or less circumscribed area. These forecasts and warnings are expected by the commercial and agricultural interests of the communities affected, and are accepted by each individual as a portion of the legitimate assets of his calling. The country at large is very slightly and indirectly affected by the work, and as a natural consequence hears but little of it. It is only when the rains become general and frequent and excessive over the great watersheds, and when the rapidly swelling tides in the rivers give notice of the coming ruin and disaster that the interest of the whole country is awakened. About two-fifths of our entire population dwell within the watersheds of the three great interior rivers, and a much larger proportion of its great producing area is comprised within their limits. The interests of all are centered in these districts, and upon their welfare depends that of all. It is at these times that the River and Flood Service of the Weather Bureau stands forth in its true light, and by the timeliness and accuracy of its warnings affords ample opportunity for the protection of human life and such property as can be saved.

The flood of March and April, 1903, in the lower Mississippi River was the greatest in its history, the stages of water alone considered, although its actual volume was very probably less than in 1897, the increased heights hav-



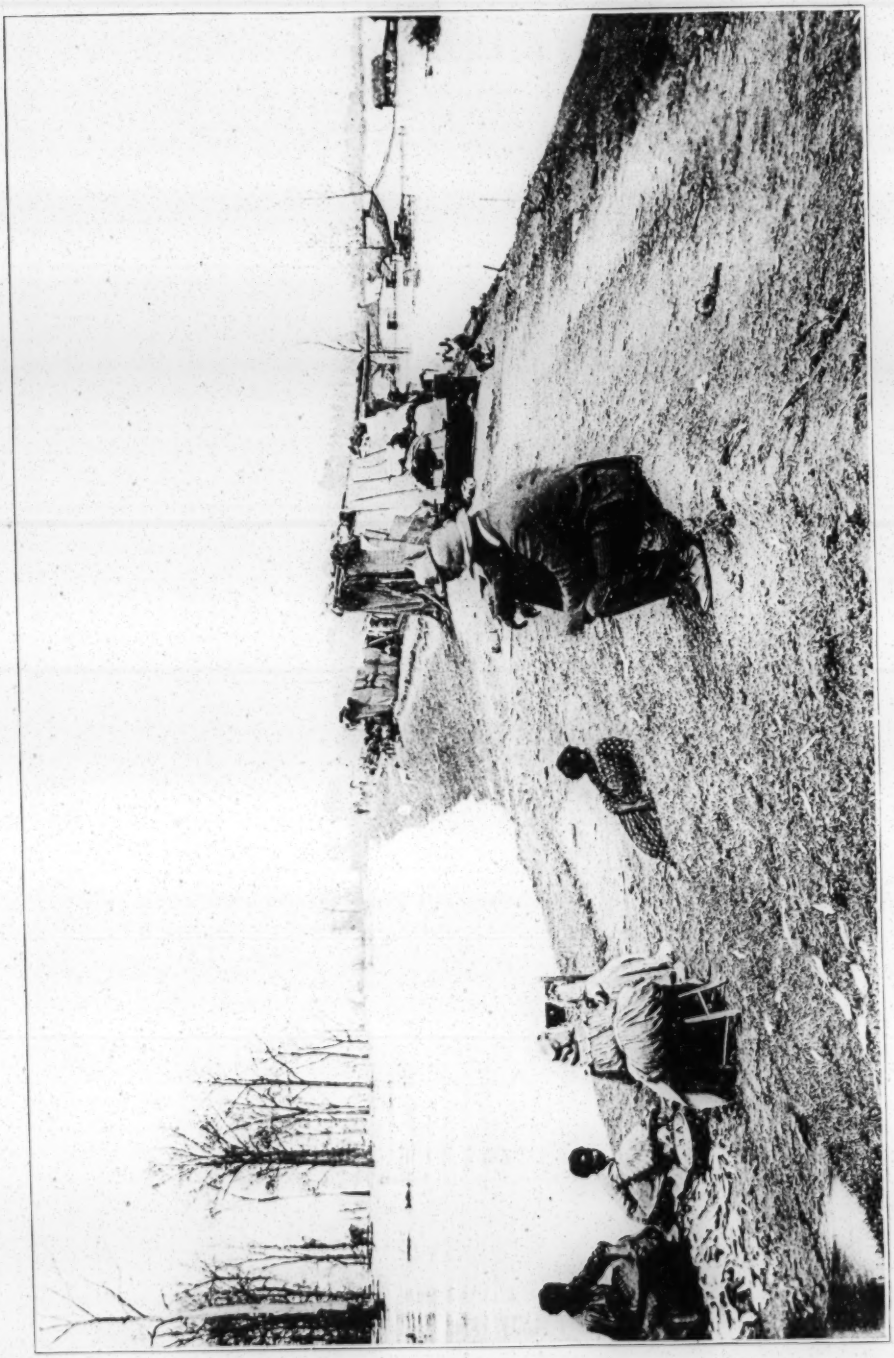
Flood Scene, Marion, Ark., March, 1903

ing been due to the extension and increased dimensions of the levee system. The confinement of the waters within a narrow channel, of course, operates to elevate the flood plane, with the natural result that a given stage of water would be recorded with a much less volume than was formerly necessary to produce the same result. An inspection of the figures immediately following will confirm this statement, Cairo being used as a reference point for the reason that all lower river forecasts are predicated upon the Cairo stages:

	1897.	1903.	Excess or deficiency. 1903.
	Feet.	*Feet.*	*Feet.*
Cairo	51 6	50.6	—1.0
Memphis	37.1	40.1	+3.0
New Orleans	19.5	20.4	+0.9

The difference was most marked at Memphis, owing to the completion of the St Francis levee, in Arkansas, since 1897, and had not this levee broken in several places the excess would have been still greater.

The Ohio and lower Mississippi Rivers, owing to a number of heavy and general rains that are the invariable accompaniments of storms of the Southwestern type, had been rising steadily during February, but not to such an extent as to warrant flood warnings until the last two days of the month, when another storm of the same type moved northeastward through the Ohio Valley. It was not necessary to wait longer. Another general rain was certain to cause overflows of the already bank-full rivers, and warnings of danger were at once telegraphed from the river centers to all points between Pittsburg and Cincinnati, the character of the advices varying with the locality. For instance, at Pittsburg, where the fast-flowing mountain tributaries make every moment valuable, warnings were given to take all necessary precautions at once, the usual time for a flood to run out being but 18 hours, while at Cincinnati several days were allowed. On the same date a general warning was issued from Memphis that owing to the recent heavy and general rains the floods would continue for two weeks longer, with stages one or two feet higher. On March 1 the people of the New Orleans district were notified to make preparations for high waters. These warnings were repeated from day to day, gradually becoming more specific as the great volumes of the tributary waters came into the main stream. There were more heavy rains on the 7th and 8th, and on March 9 warnings were issued for stages below Cairo higher than were ever before recorded, should the levees remain intact. It was also stated that the rise would continue for ten days longer at Memphis and for four week at New Orleans, when a crest stage of 21 feet was expected at the latter place, 1.5 feet higher than in 1897. At the same time a stage of 50 feet was forecasted for Cairo. These warnings were repeated daily with such slight variations as were indicated. With the experiences of 1897 so fresh within the recollection of all, there was no occasion to impress upon them the necessity of immediate action. Thousands of men were put to work at once strengthening the levees and removing portable stock to places of safety. Armed forces patrolled the levees to guard them against breaking or cutting, and every possible precaution that experience, foresight, or prudence could dictate was taken. The warnings of the 12th raised the limits still higher except at New Orleans, 50 5 feet being forecasted for Cairo and 39 feet for Memphis, the latter to occur in seven days. About March 15 there was a sudden rise at Memphis due to recently constructed levees and railroad embankments, and a



Camps of Negro Refugees, Flood of March, 1903

forecast was therefore made for a 40-foot stage within a few days. The crest stage of 40.1 feet was reached on the morning of March 20, 7.1 feet above the danger line and three feet above the high-water mark of 1897. At New Orleans the rise continued for nearly three weeks longer, and the crest stage of 20 4 feet was reached on April 6, 1.5 feet above the high-water mark of 1897. There were occasional surgings of the water to 20.7 feet, and had not the levees broken in the St Francis system and later at Hymelia, La., the forecast of a 21-foot stage made over four weeks before would have been fully verified. As it was, the error was on the right side, it being an important axiom of river forecasting to always slightly overestimate, if possible, the probable height of a flood crest.

The stages forecasted and those actually reached from Cairo to New Orleans were as follows. The forecast at Cairo was made four days in advance, and that at New Orleans 28 days in advance of the crest:

Stations.	Forecast stage.	Actual stage.
	Feet.	*Feet.*
Cairo	50.5 to 51	50.6
Memphis	40 0	40.1
Helena	51.0	51.0
Arkansas City	53.0	53.0
Greenville	49.0	49.1
Vicksburg	52 0	51.8
New Orleans	21 0	20.4 to 20.7

On the Ouachita River, 37 and 45 feet were forecasted and 36.2 and 44.5 feet reached at Alexandria and Monroe, La., respectively.

The floods of the last few days of May and the early days of June in the lower Missouri and the upper Mississippi were the greatest of any of which we have authentic record, except that of 1844. The stories of the ruin and desolation in the valley of the Kaw and at Kansas City are familiar to all. During the latter half of May persistent low barometric pressure over the eastern slope of the Rocky Mountains caused daily rainfalls of almost torrential character over Kansas, the excess above the normal amount for the season averaging about seven inches. The same conditions prevailed to a lesser extent to the eastward into northwestern Missouri and Iowa, and all streams soon became raging torrents. At Kansas City the maximum stage was 35 feet, 2 feet below the high-water mark of 1844. The records for points within the State of Kansas have not yet been verified, but there are sufficient data at hand to warrant the statement that they were higher than ever before recorded.

The first warnings of this flood were issued at Kansas City on May 26, and thereafter daily until the waters subsided. It was in connection with this flood that there occurred the single unfortunate feature of the flood work of the year. Owing to the want of sufficient funds for the purpose, no flood service has been maintained on the Kansas River, although the Missouri River is well supplied. For this reason it was not possible to forecast exact stages after May 29. On May 30 telegraph and telephone service were very uncertain, and on the 31st Kansas City was completely cut off from the west. On June 1 came the flood crest of 35 feet. The forecasts were from the necessities of the case very general in character, and stated only that a "serious flood" was imminent, and would continue as long as the rains were falling. East of Kansas City conditions were more favorable, and the forecasts were well verified, both as to time and stage. Warnings were first issued at Des Moines on the 25th of May, at Keokuk on the 28th, and at St Louis on the 30th. At this latter place warnings were issued on June 5 to prepare for a stage of 38 feet in about four days. On the fifth day that stage was exactly

reached, and the waters began to slowly recede. This stage of 38 feet was 8 feet above the danger line, and within 2.6 feet of the great high-water mark of June 27, 1844.

This flood, while, of course, much more destructive than that of 1844, did not by any means equal it in volume. In 1844 the lowlands were not occupied, there were no busy centers of industry at Armourdale, Argentine, and East St Louis, and consequently the damage done was relatively slight. The rainfall in 1844, however, was decidedly greater than in May, 1903, and there were no levees along the river to hold the waters. Yet with all bottom lands overflowed, a stage of 37 feet was reached at Kansas City on June 20 and of 41.4 feet at St Louis on June 27. At the same time the Illinois River was from 10 to 15 miles wide from La Salle to its mouth, and from Hardin down united with the Mississippi to form one continuous river. The consequence of an equal amount of rain during the present year and equally well distributed cannot be estimated with any degree of exactness. Nevertheless it is reasonably certain that several feet would have been added to the stage at St Louis, and that the entire city of East St Louis would have been totally submerged to a depth of at least 8 or 10 feet.

The annual rise of the Columbia River is always a subject of interest to the people of the north Pacific coast. This rise depends almost entirely upon the melting of the winter snows in the mountains, and there are at times wide divergences of opinion as to the probable extent of the rise and its effects upon the Willamette River at Portland, Oregon. In March of the present year the official in charge of the Weather Bureau office at Portland issued a bulletin on the subject, in which he stated that from the amount of snow then in the mountains a stage of 24 feet, or 9 feet above the danger line, would be reached at Portland about the middle of June. On June 13 the stage was 22.8 feet, with the Columbia still rising slowly.

Against such cataclysms as those at Pacolet and Heppner, flood warnings cannot avail. They are caused by torrential downpours upon extremely precipitous watersheds. Millions of tons of water are suddenly poured into a deep reservoir with but a single narrow avenue of escape. The results are then apparent, but they are beyond the province of human wisdom either to foresee or prevent.

A SUGGESTED FIELD FOR EXPLORATION

THE cabled reports tell of the continued activity of Mont Pelée in Martinique, of Colima in Mexico, and of Santa Maria in Guatemala. For a period now of eighteen months there have been unceasing volcanic disturbances in a belt extending east and west, from the west coast of Mexico to Martinique, and north and south, from central Mexico to Venezuela. Since January 1, 1902, this belt at some point or other along its length has been constantly in a state of violent disturbance. The first disturbance occurred in January, 1902, when an earthquake destroyed Chilpancingo in Mexico, and caused the loss of thousands of lives. On April 18 Quesaltenango and other towns in Guatemala were likewise ruined and fearful destruction of life resulted. On May 8 occurred the eruptions of Mont Pelée and La Souffrière, numbering 35,000 victims. In November the Santa Maria volcano in Guate-

mala erupted, and thousands of lives were destroyed. Early in 1903 Colima in Mexico erupted, and many more lives were lost. Since the eruption of Mont Pelée, on May 8, blasts even more terrific than the first fatal one have burst repeatedly from its mouth.*

We know that all these phenomena are related to each other in a general way, but what that relation is we are unable to explain. The Royal Society of England in 1902 sent two geologists to Martinique and St Vincent to study conditions there; the French Academy of Sciences did likewise; the National Geographic Society sent two eminent American geologists, Prof. I. C. Russell, head of the department of geology, University of Michigan, and Robert T. Hill, of the U. S. Geological Survey, and one foreign-born geographer, C. E. Borchgrevink; Harvard University and the National Geographic Society jointly sent Dr T. A. Jaggar, of the Department of Geology of Harvard University; the American Museum of Natural History sent one geologist, Dr E. O. Hovey, who is still in the field, and Prof. Angelo Heilprin, of the Academy of Natural Sciences, Philadelphia, has made three separate trips to the same region. But each of these expeditions has observed and studied only one point in the region of volcanic disturbance, and that point on the extreme eastern end of the belt. No one has gone to Colima or Santa Maria, on the western end, the ashes from whose craters are different from the ashes from Mont Pelée and Souffrière. The conclusions of all these expeditions deal with one locality, with one point of weakness only. What is needed is a careful examination of all the principal points of disturbance on the belt, Santa Maria in Guatemala, Colima in Mexico, etc., so that the phenomena at the various points on the belt may be carefully compared.

The trouble with all past investigations of volcanoes has been that the study has not been sufficiently complete and general. Krakatoa, Vesuvius, and Mauna Loa have each been examined and carefully watched by expert geologists and special commissions, but these investigations have been handicapped by being limited to a small area of activity. An opportunity like the present for studying active volcanic conditions, not at one point only, but at several connecting points extending over a wide region, has never before been presented.

A more comprehensive study of volcanic action will throw light on the forces writhing beneath the earth's crust. What is beneath the upper strata we do not know. By a systematic study of such a region as the volcanic belt of Central America great and invaluable information may be gained as to the origin and history of the earth.

But a far greater discovery may result from such investigation; it may be possible to foretell when volcanic disturbances are to occur, and thus to prevent such a series of catastrophes as have horrified mankind during the last eighteen months.

To carry out a careful and thorough study of this long volcanic belt would require probably less than $5,000, a mere trifle compared to the vast sums at present being expended to further exploration in the north and south polar regions. A wiser expenditure for scientific exploration could not be made, in view of our absolute ignorance today of the causes of volcanic action and the tremendous revelations that are possible from a comprehensive study of the extended region of present volcanic activity.

*Consult "Mont Pelée and the Tragedy of Martinique," by Angelo Heilprin, pages 257–270. Philadelphia: J. B. Lippincott & Co. 1903.

INTERNATIONAL GEOGRAPHIC CONGRESS

AT a conference of representatives from the several Geographic Societies in the United States, held Saturday, June 20, 1903, in the American Geographical Society Building, 15 West Eighty-first street, New York city, to arrange for the meeting of the Eighth International Geographic Congress, to be held in this country in 1904, the organization of the Committee of Arrangements was perfected by the election of Prof. W J McGee, of the National Geographic Society, Washington, D. C., chairman, and Dr J. H. McCormick, secretary. It was formally voted to hold the Congress in Washington in September, 1904, adjourning to St Louis, Missouri, to meet in connection with the International Congress of Arts and Science. In addition to the formal sessions of the Congress in Washington, it is planned to hold informal sessions or social meetings in other cities. After the final session in St Louis, a trip is planned to the City of Mexico, the Grand Canyon, Yosemite Valley, Yellowstone Park, and other points of interest to the members of the Congress. The following subcommittees were appointed: Program, Mr C. C. Adams, of the American Geographical Society; Exhibits, Mr Henry G. Bryant, of the Geographical Society of Philadelphia; Invitations, Prof. A. L. Rotch, of the Appalachian Mountain Club; Transportation, Dr G. B. Shattuck, of the Geographic Society of Baltimore; Finance, Messrs C. J. Bell, David T. Day, and Jno. Joy Edson. The appointment of other committees was deferred till the next meeting of the Committee of Arrangements. A formal prospectus will be issued in a few days.

GEOGRAPHIC NOTES

GEOLOGICAL EXPLORATION IN EASTERN ASIA

CHINA, the land which so deeply interests us politically and commercially, has also its scientific interest. Geographically it is a region of great diversity of aspects—along the Hoangho and Yangtze having great flood plains, more extensive than those of the Mississippi; along portions of its coast presenting bold promontories like the coast of the Pacific; throughout the central region exhibiting mountain ranges which the rivers traverse in deep canyons, and in its northwestern portion consisting of extensive plateaus and deserts, which extend to the heights of the Tibetan ranges. Geologically the rocks of China comprise representatives of every known geological period, and the record of the earth's history appears to be as full and as interestingly exhibited in the Middle Kingdom as in the United States. It is natural that geographers and geologists should take a lively interest in exploration of any unknown country, but with reference to China their appetite has been whetted by the suggestions of explorers who have had opportunity to travel hastily, but rarely have been able to do more than glance at the problems which presented themselves.

The Carnegie Institution of Washington, recognizing that China is a rich field of investigation, has made a grant for exploration in eastern Asia, and plans have been developed, based upon the results of extensive researches car-

ried out by Baron von Richthofen thirty years ago. The plans are comprehensive in purpose, including the study of the successions of rocks—that is, stratigraphy, the problems of structure involved in the mountains, and the history of mountain growth as expressed in the existing valleys and heights, and the paleontology of the various strata which may be encountered.

The party will consist of Mr Bailey Willis, geologist in charge, and Mr Eliot Blackwelder, paleontologist.

Mr Willis is a member of the National Geographic Society, and has been accredited its representative in China, with authority to make investigations on its behalf should opportunity occur.

These gentlemen will leave this country in July, and, proceeding by way of Europe, will confer with Baron Von Richthofen and other eminent European scientists. During the early part of September they will travel from St Petersburg to Peking by the Siberian Railway, and as soon as possible after their arrival in Peking will enter upon geological field work. The detail of operations during their sojourn in China depends upon conditions which can not now be exactly foreseen. It is expected that they will return to the United States in the summer of 1904.

THE NORWEGIAN EXPEDITION TO THE MAGNETIC NORTH POLE BY ROALD AMUNDSEN

THE following information regarding this interesting and important expedition is derived from Mr Amundsen's article in the March issue of *Terrestrial Magnetism*:

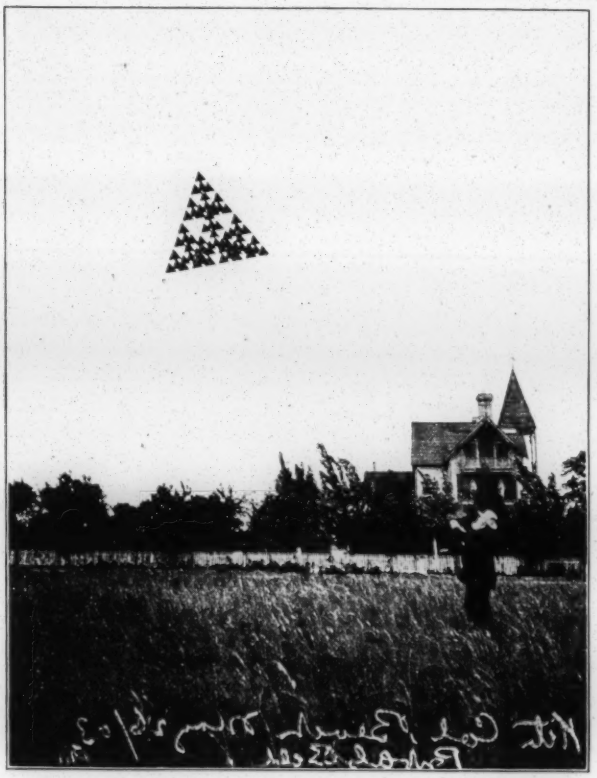
The leader, Amundsen, has taken part in the magnetic observations of the *Belgica* South Polar Expedition, and so has already had some experience in magnetic work in polar regions. His ship, the *Gjöa*, which has been especially built for Arctic exploration, is 70 feet long, 20 feet broad, and has a tonnage of about 48. She is provided with a small petroleum motor, and makes about four knots an hour. She will carry 30,000 liters of petroleum stored in iron vessels to serve for heating, cooking, and to furnish the motive power. The vessel will be provisioned for four or six years and carry a crew, with officers, of 8 men.

Mr Amundsen's instruments, which will serve for making both absolute and relative magnetic observations, were constructed and tested under the direction of Professor Neumayer while director of the "Deutsche Seewarte." His outfit also includes two sets of self-registering instruments.

He proposes to start north during the early summer of this year, stopping at Godhavn, Greenland, for dogs.

His first base station will probably be in the vicinity of North Somerset, in Leopold Harbor, from which he hopes to send news of his work in 1904 by means of whale hunters. There he proposes to make absolute magnetic observations, and also operate his self-registering instruments for a time. From this base station he likewise proposes to make sledge trips, on which magnetic observations will be made. In the summer of 1905 he may locate his base station on King William Island, and again set up his self-registering instruments. The following summer (1906) he will attempt to locate his base station at Herschel Island, and open communications with Fort McPherson, of the Hudson Bay Company. His return trip will be made by way of Bering Strait, and he proposes to stop at Sitka and make his final observations there at the U. S. Coast and Geodetic Survey magnetic observatory for the determination of instrumental constants.

Mr Amundsen thus contemplates making a complete and systematic magnetic survey of the region about the



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Tetrahedral Kite in the Air

magnetic pole, from which not only an accurate location of the magnetic pole may result, but other most important results will follow. The determination of the north magnetic pole by Captain James Clark Ross, in June, 1831, rested on a single determination. Owing to local disturbances, which may be expected in that region, there is no telling how close his determination was to the actual magnetic pole. His position was on Boothia Felix, in north latitude 70° 05′ 17″ and west longitude 96° 45′ 48″.

It is generally believed that the magnetic pole is subject to a fluctuation in its position, and it is hoped that Amundsen's work will throw some light upon the rate and direction of motion.

THE TETRAHEDRAL KITE

THE accompanying illustration shows one of Dr Alexander Graham Bell's tetrahedral kites in the air. It was received after the June number of the NATIONAL GEOGRAPHIC MAGAZINE went to press. The kite is the sixty-four-celled tetrahedral kite shown as D in figure 16, page 227 of the June number. The illustration shows the kite flying at the proper angle. The photograph was taken at Colonial Beach, Virginia, May 26, 1903, by Mr A. W. McCurdy.

PORTO RICO AND THE UNITED STATES

PORTO RICO is now furnishing a market of a million dollars a month to the producers and merchants of the United States, and supplying nearly a million dollars' worth each month of tropical products required by the United States.

These figures of commerce between Porto Rico and the United States are in marked contrast with those of earlier years. In the fiscal year 1898, which immediately preceded the transfer of Porto Rico to the United States, the exports from the United States to that island were $1,505,946. In the next year they were $2,685,848; in 1900, $4,640,449; in 1901, $6,965,408; in 1902, $10,882,653, and in the year 1903 will be about $12,000,000. Thus the total shipments from the United States to Porto Rico for 1903 will be eight times as great as those of 1898, and six times as great as those of 1897. On the other hand, shipments from Porto Rico to the United States have grown from $2,414,356, in 1898, to $8,378,766, in 1902, and

probably nearly or quite $12,000,000 in 1903, or about five times as much in 1903 as in 1898.

The United States is sending to the island cotton fabrics, iron and steel wares, and great quantities of rice, provisions, and breadstuffs; Porto Rico ships in return sugar, tobacco, coffee, and fruits.

The increased value during the last five years of Porto Rico from a commercial point of view is admirably shown by a statement recently issued by the Bureau of the Department of Commerce and Labor.

SUMMER SCHOOL OF GEOLOGY AND GEOGRAPHY AT CORNELL UNIVERSITY

THE summer school which is to be conducted by Cornell University July 6 to August 15, 1903, for students of geology and geography offers an attractive and exceedingly varied series of courses. The location of the school is itself a lesson in all that is beautiful and instructive. The campus of Cornell University is situated on a hillside, overlooking a large lake in one direction, and broad, beautifully sloping valleys in the other, and bounded by narrow gorges with many falls, cascades, and rapids. The campus is the center of a great variety of beautiful, interesting, and instructive geographic features. The excursions of most of the field courses are for the study of these features By these excursions the student is taught method and fact upon a broad range of geologic and physiographic phenomena.

The university library is fully supplied with books and magazines on geologic and geographic subjects, and these are accessible to the students in the school. The laboratories are equipped with many models, maps, photographs, and specimens illustrating phases of geology, physiography, and geography. There is, furthermore, a collection of fully 5,000 lantern slides for use in the lecture courses.

The lecture courses have been planned with great care and men selected to give them who are recognized authorities in the subjects which they are to teach. The courses and lecturers are as follows:

Physical Geography of the Lands; Prof. R. S. Tarr (Professor of Dynamic Geology and Physical Geography, Cornell University).

Laboratory Course in Physical Geography; Assistant Principal Carney (Assistant Principal, Ithaca High School) and Mr Mills (Assistant in Physical Geography, Cornell University).

Field Course in Physical Geography; Professor Tarr, Mr Whitbeck, and Mr Mills.

Dynamical Geology; Prof. A. P. Brigham (Professor of Geology and Natural History, Colgate University, Hamilton, N. Y.).

Laboratory Course in Geology; Mr Matson (Assistant in Geology, Cornell University).

Field Course in Geology; Professor Brigham, Assistant Principal Carney, Mr Matson, and Mr Mills.

Geography of the United States; Professor Brigham.

Geography of Europe; Professor Tarr.

Home Geography; Prof. C. A. McMurry (Director of Practice Department, Northern Illinois Normal School, DeKalb, Ill.).

Type Studies in Geography for Grammar Grades; Professor McMurry.

Commercial Geography; Principal Emerson (Principal Cobbet School, Lynn, Mass.).

Laboratory and Field Work in Commercial Geography; Principal Emerson.

Class-room Problems in Geography; Mr R. H. Whitbeck (Supervisor in New Jersey State Normal School, Trenton N. J.).

Physical Geography for Grades; Mr Whitbeck.

Round-table Conference, for consid-

eration of topics of geographic interest; all the teachers and such students as desire to attend.

Advanced Field and Laboratory Course in Dynamic Geology and Physical Geography; Professors Tarr and Brigham, with assistants.

The regular summer session also includes courses in Education, History, Economics, Botany, Zoölogy, and other subjects which have a bearing on geographic work.

The Summer School has also planned a series of entertaining and instructive excursions in the vicinity of Ithaca; among them excursions to Lake Ontario, to Niagara Falls, Wilkes Barre and Hazleton, and Watkins Glen.

THE SWEDISH SOUTH POLAR EXPEDITION

HON. AUGUSTUS E. INGRAM, Deputy Consul General of the United States at Paris, under date of May 29, sends to the NATIONAL GEOGRAPHIC MAGAZINE the following note of an expedition to be sent out by France in July to rescue the Swedish South Polar Expedition:

When Dr Otto Nordenskjold set out from Sweden, over a year ago, with a party of thirty-six persons on an expedition for the South Pole, his last words were: "If you are without news of me by April 30, 1903, come to my rescue, for we shall all be in great danger."

That time has come, and no news has been received of Dr Nordenskjold. In Sweden a relief expedition is being organized, but it cannot start until the end of August. Since this may be too late, and as it is thought that Dr Nordenskjold's expedition is now in the vicinity of Cape Seymour, which is French soil, the national pride of France has been stirred to be the first to rescue these brave but unfortunate men.

A vessel has already been constructed in France on the lines of the immortal *Fram* and has been named *Le Français*. Dr Jean Charcot,* well known in French scientific circles, is to command the expedition, and he will be accompanied by other scientists and experienced naval officials. The sum of 150,000 francs is, however, necessary to complete the equipment, and a leading Parisian journal, *Le Matin*, has opened its columns for a subscription list. All classes of people are responding liberally, and it is probable that the French Government, in addition to aid extended by its naval and scientific officials, will also make a contribution of money.

The expedition is expected to leave Havre on the 15th of July, and will without loss of time attempt the work of rescue. When this has been accomplished, *Le Français* will, like the *Fram*, proceed south until it is inclosed in the moving field of ice. At the opportune time a dash across the ice for the South Pole will be made.

This expedition is of especial interest, as it is now nearly three-quarters of a century since France sent an expedition to the South Pole, at which time Dumont d'Urville made considerable discoveries.

Since the expected visit to Lisbon of His Majesty Don Alfonso XIII, King of Spain, will not take place next month, the exposition of Portuguese cartography, organized by the Geographical Society of Lisbon, under the high protection of His Majesty King Don Carlos I, which was to coincide with that visit, has been postponed until next autumn.

German South Polar Expedition.—The *Gauss*, the steamer of the German South Polar Expedition, has been reported off the east coast of South Africa. Few details of the work of the party have as

*Dr Charcot had originally intended (as stated in this Magazine on page 217, May, 1903) to use his vessel for Arctic rather than South Polar exploration.

yet been received, but it would appear that, owing to the ice, they failed to get farther south than 66° 2′, and that the expedition was thus practically a failure. No expense had been spared to make the expedition a success. (It cost $400,000.) The plans had been formed after years of deliberation with the most competent men in Europe. The leader, Captain Drygalski, had proven his ability by previous work in Greenland. Bad luck alone can explain the failure of the expedition and the bitter disappointment of the German nation.

Mr W. J. Peters, the representative of the National Geographic Society on the Ziegler North Polar Expedition, was presented on his departure with the Society's flag. The flag of the National Geographic Society is of three colors—blue, brown, and green—representing respectively the air, the land, and the water.

The Swedish Government has made a grant of $20,000 to Dr Sven Hedin to enable him to publish the results of his recent explorations in Central Asia. The work will consist of a series of volumes to be completed within three years. There will be an English edition.

Prof. William H. Brewer, of Yale University, has resigned the presidency of the Arctic Club. He has been president of the Arctic Club since it was founded, eight years ago, and to his leadership is due much of the success of the organization.

Mr Robert T. Hill, of the U. S. Geological Survey, who visited Martinique as one of the representatives of the National Geographic Society, and whose preliminary reports upon the St Pierre disaster have been published in the NATIONAL GEOGRAPHIC MAGAZINE, the *Century*, and *Collier's Weekly*, is engaged upon a careful study of the scientific aspects of the eruptions, which will be presented in the NATIONAL GEOGRAPHIC MAGAZINE during 1903. He is also completing a monograph on the Windward islands for Prof. Alexander Agassiz, to be published by the Museum of Comparative Zoölogy of Harvard University. This work will be the result of several years of careful study of the islands and will thoroughly discuss the details of their geological structure and their bearing upon the alleged Windward bridge and the myths of Atlantis. Mr Hill is also engaged on a comprehensive geographical work upon the Republic of Mexico. From this country, where he has been gathering notes for the past fifteen years, he has just returned, after a most interesting mule-back trip across the southern end of the Sierra Madre between Mexico City and Acapulco.

Francis H. Herrick is the author of a recent report issued by the U. S. Fish Commission entitled "The Reproductive Period in the Lobster." Dr Herrick concludes from his experiments that the spawning periods of the female are two years apart.

The Royal Geographical Society is planning to send south the coming fall an auxiliary vessel to bring back the British South Polar Expedition. According to report, the *Discovery* has been frozen in, and is separated from open water by six miles of ice, which is too great a distance to open with a channel.

The British members of the Alaskan Boundary Commission are Lord Alverstone, Chief Justice of England; Sir Louis Jette, Lieutenant Governor of Quebec, and Justice Armour, of the Supreme Court of Canada.

An attempt to ascend Mount McKinley is being made this summer by Dr Frederick A. Cook and Mr Robert Dunn.

GEOGRAPHIC LITERATURE

A Teacher's Manual of Geography. By Charles McMurry, Ph. D.; pp. 108. New York: The Macmillan Co. 1902. $0.40

This book is designed to accompany Tarr and McMurry's admirable series of geographies. To the teacher of geography this little volume will be of much practical and suggestive assistance.

The Alaska Frontier. By Thomas Willing Balch. With 28 maps. Pp. 198, 7 x 11 inches. Philadelphia: Allen, Lane & Scott. 1903. $2.00.

Mr Balch presents in this volume the results of studies he has been making for several years on the subject of the Alaska Canadian boundary. He has not only consulted the maps of the State Department, but also made a special investigation in the archives at St Petersburg, Berlin, Paris, London, Edinburgh, and other cities. His researches have enabled him to publish a notable work, containing new facts of considerable importance.

The basis of Mr Balch's argument is a series of 28 maps, the earliest being Vancouver's chart of 1799. These maps are copies of maps published by the Russian, English, and Canadian governments. They all show the boundary exactly as claimed by the United States and agreed to by Great Britain and Canada alike for three-fourths of a century.

One of the most notable of these is British Admiralty Chart No. 787, which was first issued in 1877. Eighteen revised editions of this chart have since been issued, the latest being in 1901, three years after the Canadian claim was put forward; but each edition shows the boundary exactly as given in the United States maps.

Mr. Balch is always careful to give references to authorities referred to, a fact that is specially desirable in works of this nature. The volume is dedicated "to the memory of William H. Seward and Charles Sumner, to whom the United States owes Alaska."

Unknown Mexico. By Carl Lumholtz, M. A. Two volumes, 8vo, pp. i–xxxvi, 1–530, i–xvi, 1–496, with 15 colored plates, two large maps, and many other illustrations. New York: Charles Scribner's Sons. 1902.

As indicated by a full sub-title, this is a record of five years' exploration among the tribes of the western Sierra Madre; in the Tierra Caliente of Tepic and Jalisco, and among the Tarascos of Michoacan. It supplements a number of more technical publications, including Dr Lumholtz's splendid memoir "Symbolism of the Huichol Indians," issued by the American Museum of Natural History in 1900. The expeditions were conducted and the results prepared for publication under the auspices of various institutions and individuals, among whom the author especially credits the American Geographical Society, the American Museum of Natural History, Mr and Mrs Morris K. Jesup, Mr Andrew Carnegie, and Mrs Elizabeth Hobson. Starting with a large train in southern Arizona, Dr Lumholtz entered Sonora, and then crossed the Sierra Madre into Chihuahua; gradually the party was divided and disbanded as he worked southward along the eastern slopes of the Sierra until he was practically alone in the Tarahumare, Tubari, and Tepehuane countries, and quite without Caucasian companions in the Huichol, Cora, Tipecano, and Tarasco districts. Traveling usually by easy stages and making long stays in many of the native settlements, he enjoyed excellent opportunities for study of the habits and customs of surviving tribes, as well as

for archeologic research. Considerable collections were made of both prehistoric and modern material; most of these were sent to the American Museum of Natural History. In the northern sierra numerous habitations, both ancient and modern, were found in natural or slightly worked niches in the stupendous cliffs and barrancas; these are described as cave-dwellings, an unfortunate designation (since it tends to perpetuate the groundless notion that primordial human homes were in caves) growing out of the fact that our ordinary speech does not distinguish subterranean caverns from the open clefts or niches sometimes called rock-houses—a term too awkward for common use. In the Tarasco country imposing yacatas, or structures of stone or earth sometimes containing ornate sculptures or fictile ware, were discovered and some of them were explored, these ruins forming a connecting link between the simpler antiquities of southwestern United States and the elaborate monuments of southern Mexico, Yucatan, and Peru. Still more productive were the researches in the intermediate region, since here certain of the tribesmen were found to retain in exceptional degree their aboriginal arts and industries, their native speech, their primitive faiths, and many of the social regulations of their ancestors; and Dr Lumholtz succeeded in gaining the confidence of the Tarahumare, Tepehuan, and Huichol tribesmen so completely as to permit him to record their primitive characteristics with unexampled fullness. The ceremonial use of tobacco; the symbolism of the primitive music and dance and of the attendant costumes; the esoteric purpose of feasting; the devotional use of intoxicants; primitive marital regulations and mortuary observances; the emblematic decoration of fabrics and wares—these are but examples of the subjects apparently kept in the mind of the author throughout, and certainly elucidated with remarkable clearness in his chapters. And, so far as practicable, the points are illustrated and the observations established by photographs made on the ground or by objects collected and preserved in a great museum. In a word, the two volumes form a storehouse of facts invaluable to the working anthropologist. Throughout the record breathes a sympathy with primitive men and a depth of appreciation of their sentiments and ideas seldom seen in scientific treatises, so that it presents one of the clearest pictures of primitive life thus far drawn. The work is abundantly illustrated, largely by photomechanical reproductions, partly by engravings and lithographs bearing inherent evidence of fidelity; and the beauty of the book-making is no less striking than the excellence of the contents.

W J M.

Complete Geography. By Ralph S. Tarr and Frank M. McMurry. With many maps and illustrations. Pp. XI+478+X, 6½x8½ inches. New York. The Macmillan Co. 1902.

The plan of this text book is excellent and has been admirably carried out. Only three chapters precede the intensive treatment of the United States. The first is a physiographic history of the continent, showing how its principal mountain ranges and valleys came into existence; how its coal beds were formed; what were the effects of the great ice age; and what have been the more recent changes in the coast line, with their results. The second chapter describes the plants, animals and peoples of North America, and the third explains latitude and longitude. Then follow seven chapters on the United States, each dealing with one group of states. The rest of North America is then described. By this arrangement the more difficult subjects of General Geography, seasons, winds and rain, ocean movements and distribution of

temperature, forming Part II of the volume, are deferred until the pupil is better prepared to understand them. Part III deals with South America, Part IV with Europe, and Part V with Asia, Africa, Australia, and Island Groups. The maps and illustrations, of which there are 500, are well chosen and are very clearly and beautifully reproduced.

Through the Heart of Patagonia. By H. Hesketh Prichard, F. R. G. S., F. Z. S., etc. Large 8vo, pp. i–xvi, 1–346, with 40 plates and 3 maps. New York: D. Appleton & Co. 1902.

In 1897 Dr F. P. Moreno stumbled on a piece of skin containing bony tubercles, which had been found with human remains in a Patagonian cave; the character of the integument and the associations suggested that it was from a Mylodon (or Giant Ground Sloth) of Tertiary facies perhaps still surviving, and Dr F. Ameghino used it as the type of a new genus and species, *Neomylodon listai*. A portion of the skin was taken by Dr Otto Nordenskjöld; another piece passed into the hands of Prof. E. Ray Lancaster, Director of the British Museum of Natural History, and Dr A. Smith Woodward, who made a critical study, as did also Dr S. Roth, who identified it with a Pampean genus related to Mylodon and renamed it *Grypotherium listai*. The find, in associations indicating that the animal was stabled in the cave and fed by early man, together with attendant rumors that it had been seen alive, naturally attracted much attention. Among those interested was Mr C. Arthur Pearson, of London, who financed an expedition in charge of Mr Prichard to search for further traces of the animal. This expedition failed of its primary purpose, since neither remains nor living specimens of Grypotherium were found; yet it was successful in practically demonstrating that the creature no longer lives in its former range, and also in extending exploration of the southern Andean region. Among the results of permanent value may be noted surveys about the eastern portion of Lake Buenos Aires; explorations and surveys about Lake Argentino, including the discovery of Lake Pearson; the finding of a new puma (*Felis concolor pearsoni*); various notes on the habitat and habits of Patagonian animals; a study of "The first attitude of wild animals toward man;" and useful ethnologic observations, chiefly on the Tehuelche tribe. The sumptuous report details these results, and also forms an interesting record of travel and adventure, satisfactorily illustrated by reproductions of the author's photographs, as well as by more fanciful sketches in color and tint; while a full Appendix contains reprints of the principal papers on Grypotherium, together with a note by the author on the native legends, a description of the new puma by Oldfield Thomas, and a list of plants, with their localities. A suggestive chapter on the future of Patagonia touches on the resources of this portion of the great country, Argentina, sometimes of late fitly styled the United States of South America. The book is handsome, despite the somewhat inferior typography and labo*u*red orthography of the English press.

W J M.

Three Notable Works on Alaska, the results of extended explorations in the territory in 1901, have been published by the Survey: "Preliminary Report on the Ketchikan Mining District," by Alfred H. Brooks, Ketchikan; "Reconnaissance from Fort Hamlin to Kotzebue Sound," by way of Dall, Kanuti, Allen, and Kowak rivers, by Walter C. Mendenhall; "Reconnaissance of Northwestern Portion of Seward Peninsula," by Arthur J. Collier.

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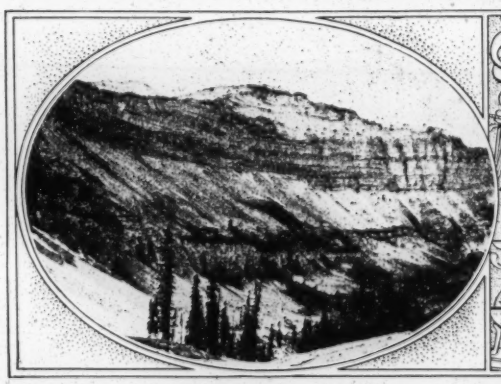

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